ASSESSMENT OF LAKE TROUT BACKCROSS IN SOUTHERN GEORGIAN BAY, 1987

Ontario
Ministry of
Natural
Resources

ASSESSMENT OF LAKE TROUT BACKCROSS IN SOUTHERN GEORGIAN BAY, 1987

D.N. Hughes

Ontario Ministry of Natural Resources
Lake Huron Fisheries Assessment Unit
611 Ninth Avenue East
Owen Sound, Ontario N4K 3E4

Report 2-88

June 1988

ABSTRACT

Annual index gillnetting for lake trout backcross in southern Georgian Bay in 1987 showed declines of 22% and 38% in abundance and biomass respectively (no/1000 m and kg/1000 m), compared with 1986 results. Mean age and mean weight dropped slightly at Cape Rich but increased marginally in Owen Sound. Catch rates for backcross aged 3 and 4 yr were substantially lower (28-66%) at both sampling areas, consistent with the lesser strength of those cohorts evident from previous years' results. The 56% decline in age 2 CUE at Owen Sound was expected because of the 50% reduction of backcross plantings when the matched plantings of lake trout began in 1986. Yearling CUEs increased 28% at Cape Rich and 66% in Owen Sound. Except for six-year-old backcross in Owen Sound, CUEs for fish five to eight years of age were higher than in 1986, continuing the trend evident since 1984 when commercial harvest was reduced.

Estimates of total mortality (38-79%) for most cohorts remained above the target of 40% recommended for lake trout rehabilitation, although they were still lower than the 90% mortality estimates obtained prior to harvest controls.

Maturity by size and by age was similar to previous findings. Fifty percent maturity was attained at about 42 cm FL for males and 47 cm FL for females. By age, percent maturity for males and females respectively was: 11% and 4% at age 2, 72% and 36% at age 3, and 96% and 91% at age 4.

Rainbow smelt were again the dominant component of the diet of backcross, occurring in 59% of all non-empty backcross stomachs, and making up 99% of the identifiable fish prey items. Sculpins, alewife, sticklebacks and darters were the other fish species represented. The diet of burbot was more diverse, featuring lesser dominance by smelt, the inclusion of crayfish and greater contribution from other fish species.

Fry emergence trapping was not as successful as in the previous two years because of a late start, (presumed) earlier hatching than normal, and two severe winter storms that caused considerable disturbance of the rubble substrate. Gillnet catches of backcross with no apparent fin clip remained too low to provide conclusive evidence of natural recruitment to that gear.

Lamprey marking rates on backcross remained very low, at 1.9 wounds/100 fish and 4.8 scars/100 fish (n=2146) for the two areas combined.

Review of progress toward rehabilitation indicates that a high abundance of mature backcross has been established, and that successful reproduction has been observed since 1985. However, increased production of wild fish appears necessary to accelerate achievement of self-sustaining stocks. Reduction of fishing mortality may be required to ensure greater spawner densities and hence egg deposition.

TABLE OF CONTENTS

	Page
Abstract	i
Table of Contents	iii
List of Tables	iv
List of Figures	v
List of Appendices	v
Introduction	1
Planting areas and assessment sites	2
Methods	3
Results	
Catch composition	6
Backcross abundance and CUE-at-age	6
Mortality estimates	7
Growth, maturity and diet	8
Reproduction	9
Lamprey marking	10
Discussion: progress toward rehabilitation	11
Acknowledgements	15
References	16
Appendices	31

LIST OF TABLES

		Page
1.	Planting statistics for yearling lake trout backcross stocked in southern Georgian Bay, 1979-1987	18
2.	Total catch by mesh size from index gillnetting at Cape Rich, August 1987	19
3.	Total catch by mesh size from index gillnetting in Owen Sound bay, August 1987	20
4.	Index gillnetting CUEs (no/1000 m) at Cape Rich, 1979-1987	21
5.	Index gillnetting CUEs (no/1000 m) at Owen Sound, 1984-1987	22
6.	Summary of index gillnet catches of lake trout backcross at Cape Rich, 1979-1986, and Owen Sound, 1984-1987	22
7.	Age distribution by mesh size for lake trout backcross from index gillnetting at Cape Rich, August 1987	23
8.	Age distribution by mesh size for lake trout backcross from index gillnetting at Owen Sound, August 1987	23
9.	CUE-at-age summary for lake trout backcross from index gillnetting at Cape Rich, 1979-1986, and Owen Sound, 1984-1987	24
10.	Estimated total annual mortality for lake trout backcross from index gillnetting at Cape Rich and Owen Sound, 1987	24
11.	Fork length/age distribution of backcross sampled from index gillnetting at Cape Rich, August 1987	25
12.	Fork length/age distribution of backcross sampled from index gillnetting at Owen Sound, August 1987	26
13.	Size/maturity summary for lake trout backcross from index gillnetting at Cape Rich and Owen Sound, August 1987	27
14.	Age/maturity summary for lake trout backcross from index gillnetting at Cape Rich and Owen Sound, August 1987	28
15.	Percent frequency (and counts of fish prey) for stomach contents of lake trout backcross and burbot from index gillnetting at Cape Rich and Owen Sound, August 1987	28
16.	Results of fry emergence trapping for lake trout backcross in Owen Sound, 1985-1987	29
17.	Occurrence of backcross with no apparent fin clip from index gillnetting in southern Georgian Bay, 1986-1987	29
18.	Lamprey marking rates for backcross from index gillnets at Cape Rich and Owen Sound, August 1987	29

LIST OF FIGURES

Page

1. Index gillnet CUEs for mature backcross at Cape Rich 30

LIST OF APPENDICES

Page

A. Common and scientific names of fish species from index gillnetting for lake trout backcross in southern Georgian Bay, 1979-1987 31

B. Catches, depth and temperature data from individual gillnet sets for lake trout backcross in southern Georgian Bay, 1987 ... 32

INTRODUCTION

Lake trout in the Georgian Bay basin were decimated by sea lamprey predation in the mid-1950s and became extinct by the early 1960s (e.g., Berst and Spangler 1973). Rehabilitation of the lake trout became a goal of the Ontario Ministry of Natural Resources under agreement with the Great Lakes Fishery Commission.

Because early plantings of yearling lake trout in South Bay, Manitoulin Island suffered high mortality from sea lamprey (Budd and Fry 1960), a faster growing, early maturing hybrid was considered necessary to ensure adequate survival to maturity. Select splake hybrids were planted from 1969 to 1977, but were unsuccessful due to disease in the hatchery and insufficient survival to maturity in the lake (LHFAU 1979).

The rehabilitation program then shifted to the lake trout backcross, with plantings beginning in 1979 in southern Georgian Bay. At the same time, improved hatchery conditions and planting methods were incorporated to ensure good rearing success and post-stocking survival. The results were immediate and impressive. Returns to assessment nets far exceeded previous returns of the original splake hybrid (LHFAU 1980,1981), and both the sport and commercial fisheries quickly realized benefits from the high abundance of this desirable species. The resulting fishing pressure led to excessive mortality of backcross beyond age 2, and measures to reduce commercial harvest were implemented during 1981-1984. Abundance of older backcross began to rise, and successful reproduction was noted in 1985 and 1986 (Hughes 1987).

Meanwhile, the fish community continued to change during the 1980s. Burbot abundance gradually increased from very low levels (Hughes 1987a,

1987b); natural reproduction of pacific salmon was recorded in southern Georgian Bay tributaries (Toth 1984; Kerr and Perron 1986); local plantings of chinook salmon were initiated; and lake trout plantings were added to the backcross stocking as a paired planting experiment in Owen Sound bay. Also, a large cladoceran zooplankton species, Bythotrephes cederstroemi (see Bur et al. 1986; Lange and Cap 1986), native to Europe became very prominent in the lake, and showed up in the diet of several fish species. The changing biota may contribute to changes in the resident backcross population.

The sport fishery has also been dynamic, with the development of substantial winter, spring and summer fisheries for backcross along with enhanced fisheries for salmon, rainbow trout and brown trout. Increased fishing pressure is also coming from organized fishing derbies.

Rehabilitation progress to 1983 was discussed by Henderson and Payne (1988), with reference to previous changes in the fish community.

This report summarizes the results of the 1987 assessment program for lake trout backcross in southern Georgian Bay, including discussion of changes in abundance, age structure, and estimated mortality rates during the 1979-1987 period. Also provided are comments on the progress toward the goal of rehabilitating Georgian Bay's lake trout population.

PLANTING AREAS AND ASSESSMENT SITES

A summary of the numbers stocked each year at each site in southern Georgian Bay is presented in Table 1. Other plantings of backcross have been made in the eastern North Channel (1978, 1980-1987), in South Bay, Manitoulin Island (for a research project comparing backcross and lake

trout) and in Parry Sound, where rehabilitation of a remnant native lake trout stock is under way.

Some experimention has been incorporated into the southern Georgian Bay rehabilitation program, including: (i) a study of the effect of planting date and size at planting, during 1979-1981 at the Cape Rich site; and (ii) a paired planting experiment involving lake trout and backcross, begun in 1986, in Owen Sound bay.

Assessment activities have primarily been graded-mesh gillnetting projects, carried out annually by the Lake Huron Fisheries Assessment Unit (LHFAU). The most intensive and longest-running project has been the index gillnetting program at Cape Rich, which has been conducted every August from 1973 to the present. A second assessment netting project was begun in Owen Sound bay in 1984, primarily to examine the backcross population in an area that had been free of commercial exploitation for three years. In addition, some surveys of spawning and fry emergence have been carried out in the Owen Sound and Meaford areas of southern Georgian Bay.

METHODS

CAPE RICH

Index gillnetting for backcross (and originally for the splake genotype) has been performed annually during late summer when thermal stratification tends to concentrate the fish in the thermocline. Two gillnet gangs were fished daily, at one location off the the east side of Cape Rich. Each gang comprised two series of eight mesh sizes from 38 mm to 127 mm, in 12.7 mm intervals (1.5 to 5.0 inches, by 0.5 inch increments), assembled in order of mesh size. Each mesh size panel was 91 m (100 yd)

long, except for the 38 mm panels which were just 46 m (50 yd) in length. Total length of each gang was 1372 m, or 1500 yd.

Nets were made using two-strand nylon twine (210/2), hung "on the half" (i.e., 200 yd of twine was hung on 100 yd of side-line to assemble a 100 yd panel). Numbers of meshes deep for each panel were such that the nets were about 1.8 m high when fishing.

Nets were set parallel to each other, about 0.5-1.0 km apart. Set orientation alternated daily between perpendicular to shore and parallel to shore. Depths were determined according to the temperature profile taken by bathythermograph prior to setting. A target temperature of about 12 C (at lake bottom) served to guide the selection of fishing depth, along with the exercise of some judgement in predicting subsequent shifts in the thermocline based on wind conditions.

Fishing effort was originally set at 20 days of net lifts, but was cut back to 14 days in 1980, and to 10 days in 1984, in response to increasing catches of backcross. Total yardage of gillnet was therefore 60,000 yd initially, then 42,000 yd, and most recently 30,000 yd for the project. When compiling catch per unit effort (CUE) data, the effort was adjusted for occasional two-night sets caused by weather conditions. CUE-at-age was also corrected for mesh panel length by doubling the catches from the shorter panels of 38 mm mesh size.

All lake trout backcross captured were retained for sampling in the laboratory, involving measurement of fork length, total length and round weight, and recording of fin clip, lamprey marks, sex, maturity, and stomach contents (count and identity). Scale samples were collected to permit age assignment where there was no discernible fin clip or where the fin clip corresponded to more than one possible age.

OWEN SOUND

The design for the Owen Sound netting project differed somewhat from that for Cape Rich. Four sites within the bay were fished twice during each year's operation, but only one gang was set at a site at any one time, as opposed to the two gangs used at Cape Rich. Because of the varying slope among the four sites, all nets were set along a given depth contour (corresponding to the target temperature of 12 C), roughly parallel to shore. Total effort was four days of net lifts, at two gangs (and two sites) per day, for a total of 12,000 yd of gillnet.

All backcross caught were sampled as outlined above for the Cape Rich project.

EMERGENT FRY TRAPPING

This project was limited to just one spawning site in Owen Sound bay, and only nine traps were used. Each trap covered a circular area of 0.5 m^2. Emergence traps were normally set shortly after ice-out, on areas of a spawning site that had been marked the previous fall to indicate where spawning activity had been concentrated. Inverted glass jars atop the traps were examined weekly for swim-up fry. Any fry caught were taken for rearing in a fish culture research lab for subsequent electrophoretic analysis. Traps have usually been removed in late June.

In 1987, traps were not set until May 14 because of an initial lack of funding for the project.

RESULTS

CATCH COMPOSITION

The 1987 catches by mesh size for all species at Cape Rich and Owen Sound are listed in Tables 2 and 3. In both cases, alewife were caught in greatest numbers. Backcross and white suckers were the next most prominent at Cape Rich, while bloaters and white suckers followed alewives numerically in Owen Sound. Appendix B contains the catches from individual gillnets, along with the depth and temperature data for those sets.

Catch rates for all species in index gillnets at Cape Rich during 1979-1987 are shown in Table 4. Table 5 contains the 1984-1987 Owen Sound CUEs. The declining catch rate for backcross in Owen Sound is discussed later in regard to the age structure of the backcross population. Discussion of changes in catch rates of other species is included in an annual report on the LHFAU index fishing program (Hughes 1988b).

BACKCROSS ABUNDANCE AND CATCH-AT-AGE

Index gillnet CUEs for backcross are summarized in Table 6. The 1987 CUE at Cape Rich was down 14% by numbers and 34% by weight from 1986. These declines were not unexpected given the CUE-at-age data from 1985 and 1986 (Table 9, discussed further in this section), which indicated that fewer three- and four-year-old backcross would be present in 1987. Abundance has remained high and relatively stable since the implementation of harvest controls in 1984, and much greater than the abundance attained by the original splake hybrid planted prior to 1978 (CUEs of only <1-7 per 1000 m; LHFAU 1979). The 1987 Cape Rich CUEs were also affected to an unknown degree by either accidental entanglement of downriggers in the nets, or deliberate tampering on at least three occasions, which greatly reduced the

fishing power of those sets. In addition, catch rates in 1987 were likely lower because of the colder temperatures fished (mean 8.4 C; Appendix B), compared with 1986 (mean 11.8 C; LHFAU data).

The Owen Sound CUE data in Table 6 reveal a continuous drop in backcross numbers from 107.0/1000 m in 1984 to 46.1/1000 m in 1987. The CUE in kg/1000 m decreased from 1986 to 1987 for the first time, although mean individual weight increased slightly. As shown below, these changes in CUE have resulted from reduced abundance of younger age groups (ages 1-4 in 1987) and rising catch rates for older age groups.

Prorated 1987 backcross age distributions by mesh size are presented in Tables 7 and 8 for Cape Rich and Owen Sound, respectively, while Table 9 shows the CUE-at-age data for all years at both sites. At Cape Rich, CUEs for age 3 and 4 backcross were down markedly from the 1986 levels. The ages 1 and 2 catch rates, although higher than in 1986, were nonetheless low relative to some earlier years. Catch rates for age groups 5 to 8 were all higher than in any previous year, continuing the trend established in 1984. For Owen Sound, the low 1987 abundance of age 1 and 2 backcross was expected because of the 50% reduction of backcross numbers planted when lake trout stocking began for the paired planting experiment. Poorer survival of yearlings in 1984 and 1985, possibly due to losses to predation (Hughes 1988a), could account for the poor showing of three- and four-year-old fish in 1987.

MORTALITY ESTIMATES

Estimates of total annual mortality from August 1986 to August 1987 (Table 10) ranged from 38% to 79% at Cape Rich, and 45% to 74% in Owen Sound. No estimate could be made for age 2 to 3 at Cape Rich because the

1987 CUE for that cohort was greater than the 1986 CUE. Prior to implementation of harvest controls in 1984, estimated total mortality often exceeded 90% beyond age 2 (LHFAU data), so the recent mortality estimates signify considerable improvement in survival. However, the 1987 figures were all higher than in 1986, and mostly well above the guideline of 40% total mortality recommended by the international Lake Trout Technical Committee.

GROWTH, MATURITY AND DIET

Tables 11 and 12 show size-at-age data for the backcross caught in August 1987 at Cape Rich and Owen Sound, respectively. The variability in growth rate is clearly indicated, with each age class from 2 to 5 yr spanning about 30 cm in fork length distribution.

Maturity data by size and age are compiled in Tables 13 and 14 for the two sampling locations. In terms of size (both areas combined), 50% maturity for males occurred at about 42 cm FL, and for females at about 47 cm FL. Maturity by age for males (again combining both locations) was 72% at age 3 and 96% at age 4; the corresponding figures for females were 36% and 91% respectively.

Stomach contents of backcross and burbot from the Cape Rich and Owen Sound netting projects are summarized in Table 15. As has been observed in previous years, smelt were the primary prey of backcross, occurring in 59% of all non-empty backcross stomachs and making up 99% of the identifiable fish prey items. Sculpins, alewives, sticklebacks and darters were fish species observed in much lower frequency. Among the crustaceans encountered

in backcross stomachs was the cladoceran zooplankton, Bythotrephes cederstroemi, a recent "invader" from Europe (Lange and Cap 1986; Bur et al. 1986).

The diet of burbot is of interest here because of that species' predation on planted backcross and lake trout in spring (Hughes 1988a), and because of potential competition between backcross and burbot. As in previous years, burbot caught in August relied heavily on smelt, but less so than did backcross. Smelt were found in 36% of the non-empty burbot stomachs, and represented 60% of the identifiable fish or crayfish prey. Alewife, sculpins, sticklebacks, darters, bloater, yellow perch and salmon were other fish species observed in burbot. Contrary to previous years, the frequency of crayfish in burbot stomachs was lower in Owen Sound than at Cape Rich. The smaller mean size of burbot caught in Owen Sound (FL 488 mm vs 553 mm at Cape Rich) may have been a factor; a lesser frequency of fish, and greater frequency of crustaceans was also noted. B. cederstroemi was included in the crustaceans eaten by burbot.

The absence of trout in any stomachs examined in August 1987 is consistent with observations from other years. Evidently, planted trout have ceased to be significantly vulnerable to predation by late summer, in contrast to the situation shortly after stocking when both burbot and backcross consume planted trout (Hughes 1988a).

REPRODUCTION

(i) Emergent fry trapping

The 1987 backcross fry trapping operation was hampered by several factors, including: two severe winter storms causing obvious disturbance to the spawning site under study, a late start (May 14/87) due to funding

problems, and a presumed earlier than normal emergence caused by rapid warming of surface water temperature in April. (Lake whitefish hatching was evidently accelerated by two weeks in the Fishing Islands area; LHFAU data.)

In light of the above setbacks, a nil catch for 1987 was considered quite likely. The actual result was a catch of only one fry, which was reassuring to a degree since it indicated at least some survival of the winter storm damage. Unfortunately, the late start of trapping precluded more informative assessment of the reproductive performance of backcross at this site. The 1985-1987 results of fry trapping operations are listed in Table 16.

(ii) Occurrence of unmarked backcross

Table 17 shows the incidence of unclipped backcross in 1986 and 1987 as percentages of each age group. Assuming no between-year variation in fin clipping quality at the hatchery, fin regeneration would cause the proportion of "unclipped" fish to increase with age. The observed "unclipped" backcross of age ≥ 3 likely reflect fin regeneration, but some or all of the yearlings and two-year-olds with no fin-clips could have been fish produced in the wild. Larger percentages of unclipped age 1 and 2 backcross will be required to provide conclusive evidence of recruitment of naturally-produced backcross.

LAMPREY MARKING

The lamprey marking rates on the 2,146 backcross examined in August 1987 at Cape Rich and Owen Sound were 1.9 wounds per 100 fish and 4.8 scars per 100 fish, compared with 1.7 and 3.1 in 1986. The incidence of marking was greater on backcross caught at Owen Sound than those from Cape Rich

(Table 18), possibly because of the larger mean size of fish from the Owen Sound catches. In 1986, mean size and lamprey marking rate were greater at Cape Rich.

The observed wounding rate on backcross is much lower than the rates encountered in 1987 for lake trout in the western North Channel and in the Huron basin (Payne et al., 1988). Lamprey-induced mortality is therefore not considered a significant factor for backcross in southern Georgian Bay.

No other species bore lamprey marks in 1986 in the southern Georgian Bay assessment, but some marking was noted on lake whitefish and burbot in 1987. Rates for whitefish were 1.5 wounds/100 fish and 0.5 scars/100 fish (n=198), and for burbot were 1.1 wounds/100 fish and 0.6 scars/100 fish (n=465).

DISCUSSION

PROGRESS TOWARD REHABILITATION

The objective of the lake trout backcross program is to establish a self-sustaining population, as a step toward the goal of rehabilitating Georgian Bay's lost lake trout resource. By stocking large numbers of yearling fish, the aim is to develop a population of mature fish sufficient to produce substantial recruitment of progeny. This discussion deals with the progress so far in accomplishing the program's objective.

Important population attributes affecting the capacity for a planted stock to become self-sustaining include: numbers stocked, survival rate, growth rate, maturation schedule, sex ratio, success rates for egg fertilization and incubation, and post-emergence survival of naturally

produced progeny. These factors interact to yield two key determinants: abundance of spawners, and number of lake-produced fish that recruit to the population.

Clearly, a sizable stock of backcross has been established in southern Georgian Bay, after an eight year period of stocking. In fact, high abundance would have been attained sooner had harvest controls been in place at the beginning of the backcross plantings in 1979. Estimates of total mortality at Cape Rich dropped from around 90% in the early 1980s to 40-60% after reduction of commercial harvests in 1984, allowing older backcross to become more numerous. Figure 1 illustrates the increasing CUEs for mature backcross at Cape Rich. Assuming that those CUEs reflect actual abundance of mature fish, the number of spawners increased dramatically from 1983 to 1986, then dropped in 1987 to about the 1985 level. Projections for 1988 (based on 1987 CUEs-at-age and 1984-1987 mortality estimates) indicate that spawner abundance should remain about the same. Also of significance is the increasing proportion of females in the mature population, from 18% in 1984 to >40% in 1986 and 1987.

During this period of increasing spawner abundance, evidence of successful spawning and incubation was obtained in Owen Sound (Table 16). The first fry captures in 1985 came after only six years of backcross stocking, compared with first lake trout fry captures after nine years in Lake Huron (Nester and Poe 1984) and twelve years in Lake Michigan (Wagner 1980; Jude et al. 1981). Progress to that stage, therefore, was as good as could be hoped for, given the setback of high fishing mortality in the early 1980s.

However, as has been the case with lake trout stocked in Lakes Huron, Michigan and Ontario, there has not been substantial recruitment of

lake-produced yearlings or two-year-olds. Degraded spawning habitat, contaminants, inability of planted trout to congregate on former spawning shoals (due to lack of imprinting), inadequate abundance of spawners from several age groups, and predation on eggs, fry or juveniles are factors that have been suspected as responsible for the failure of planted lake trout to reproduce extensively in those lakes (e.g., Mac et al. 1985; Eshenroder et al. 1984).

For backcross in southern Georgian Bay, spawning habitat quality and contaminant burdens are not considered to be obstacles to reproduction. Since wild fry have been captured with only a minimal amount of effort, large numbers are probably being produced each year. But with no conclusive recruitment of lake-produced backcross into the assessment gear, either fry production or fry survival (or both) is insufficient at present. If the fry densities observed in 1985 and 1986 (Table 16) apply generally to backcross spawning shoals, then 7,500-30,000 fry are currently produced per hectare of spawning habitat utilized. Unless backcross spawning is widely distributed over large areas, that rate of fry production may be too low to result in measurable recruitment of wild backcross yearlings or older fish. Predation by smelt, burbot, planted backcross or other fish may also be affecting post-emergence survival of backcross hatched in the wild.

Despite the rapid increase in abundance of spawners since 1983, further improvement may be needed. Guidelines for lake trout total mortality rates have been recommended by international Lake Trout Technical Committees to serve as benchmarks for rehabilitation programs. On Lake Huron the mortality guideline is 40%. The total mortality estimates for most backcross cohorts in southern Georgian Bay still exceed that level (Table 10), suggesting that additional harvest controls should be considered in

order to enhance the amount of natural reproduction. Unfortunately, estimates of fishing mortality are not available, so it is not possible to determine how much reduction of harvest would be required to meet the mortality guideline.

Also, knowledge of the amounts of sport and commercial harvest in southern Georgian Bay is incomplete at best. Estimated annual gillnet catches of backcross in the Meaford-Thornbury commercial fishery averaged about 3,300 fish (range 1400-7000) during 1984-1987 (McNeil et al. 1988), but no estimates are available for the Native commercial fishery north of Colpoys Bay. Based on creel surveys conducted during 1982-1985, the mean estimated angler harvests of backcross were 7,900 and 4,700 for Owen Sound and Colpoys Bay, respectively, for the winter and spring periods combined (LHFAU unpublished data). More recently, a substantial summer fishery has developed as well, but no estimates of harvest from that time period are available. Expansion of a spring fishing derby and introduction of a new late summer derby will likely produce increased angling effort and harvest in 1988. Backcross are also prominent in a considerable but unquantified sport fishery in the Meaford to Collingwood area of southern Georgian Bay. Farther east, the spring angling fishery in the Wasaga area of Nottawasaga Bay produced estimated catches of 2,700 backcross during 1983-1986 (Craig 1988). Estimated commercial gillnet catches in eastern Nottawasaga Bay averaged about 4,000 backcross for the years 1984-1986 (McNeil et al.1988).

In summary, the backcross program has achieved success in establishing a large population of mature fish, with demonstrated successful reproduction to the stage of fry emergence. The lack of substantial recruitment of wild fish beyond that stage, coupled with identical experiences with lake trout elsewhere in the Great Lakes, suggests that the spawning population still

requires further enhancement through reduction in total mortality.

ACKNOWLEDGEMENTS

The author acknowledges with thanks the conscientious efforts of the many LHFAU staff who participated in various portions of this program. For most of the 1987 program, gillnetting operations were carried out by Darrell Wilson, Joe McLay and Gord Toth, while laboratory sampling was conducted by Ed deLaPlante, Jessie Luna, and Steven Denstedt. E.d.L. also performed the age interpretations from scale samples of backcross, where necessary. Jim Hastie handled the training, scheduling and supervision of the boat and lab crews, and audited the data collection. Sylvia Mannonen entered and maintained the data files, and system support was provided by Fergus McNeil. Bob Payne designed the index gillnetting program, and contributed to many improvements in the content of this report.

REFERENCES

Berst, A.H. and G.R. Spangler 1973. Lake Huron: the ecology of the fish community and man's effect on it. Great Lakes Fishery Commission Tech. Rep. 21: 41 pp.

Budd, J.C. and F.E.J. Fry 1960. Further observations on the survival of yearling lake trout planted in South Bay, Lake Huron. Can. Fish Cult. 20: 1-4.

Bur, M.T., D.M. Klarer and K.A. Krieger 1986. First records of a European cladoceran, Bythotrephes cederstroemi, in Lakes Erie and Huron. J. Great Lakes Res. 12(2): 144-146.

Craig, R. 1988. Lake trout backcross creel surveys, Nottawasaga Bay, Huronia District, 1983-1986. Ont. Min. Natur. Resour., Huronia District, MS Rep., 27 pp.

Eshenroder, R.L., T.P.Poe and C.H. Olver (eds.) 1984. Strategies for rehabilitation of lake trout in the Great Lakes: Proceedings of a conference on lake trout research, August 1983. Great Lakes Fish. Comm., Tech. Rep. No. 40: 63 pp.

Henderson, B.A. and N.R. Payne 1988. Changes in the Georgian Bay fish community, with special reference to lake trout (Salvelinus namaycush) rehabilitation. Hydrobiologia 163: (in press).

Hughes, D.N. 1987a. Assessment of lake trout backcross in southern Georgian Bay, 1986. Lake Huron Fish. Assess. Unit Rep. 1-87, 27 pp.

_____ 1987b. Lake Huron index fishing program, 1986. Lake Huron Fish. Assess. Unit Rep. 3-87, 49 pp.

_____ 1988a. Predation on newly planted lake trout and lake trout backcross in southern Georgian Bay. Lake Huron Fish. Assess. Unit Rep., in prep.

_____ 1988b. Lake Huron index fishing program, 1987. Lake Huron Fish. Assess. Unit Rep., in prep.

Jude, D.J., S.A. Klinger and M.D. Enk 1981. Evidence of natural reproduction by planted lake trout in Lake Michigan. J. Great Lakes Res. 7:57-61.

Kerr, S.J. and D.A. Perron 1986. An examination of chinook salmon, Oncorhynchus tsawytscha, smolting activity in six selected Lake Huron-Georgian Bay tributaries. Owen Sound District Rep., 18pp + app.

Lange, C. and R. Cap 1986. Bythotrephes cederstroemi (Schodler). (Cercopagidae: Cladocera): A new record for Lake Ontario. J. Great Lakes Res. 12(2): 142-143.

LHFAU 1979. Report of the Lake Huron Fisheries Assessment Unit to the Lake Huron Committee; 29pp. Appendix III in Great Lakes Fish. Comm., Minutes of the Lake Huron Committee, 21 February 1979.

_____ 1980. Report of the Lake Huron Fisheries Assessment Unit to the Lake Huron Committee, 11-12 March 1980; 18 pp.

_____ 1981. Report of the Lake Huron Fisheries Assessment Unit to the Lake Huron Committee. Appendix VII, pp73-86 in Great Lakes Fish. Comm., Minutes of the Lake Huron Committee, 10 March 1981.

Mac, M.J., C.C. Edsall and J.G. Seelye 1985. Survival of lake trout eggs and fry reared in water from the upper Great Lakes. J. Great Lakes Res. 11: 520-529.

McNeil, F.I., N.R. Payne, and E. deLaPlante 1988. Estimated catches of rainbow trout, brown trout, lake trout and Pacific salmon in commercial gillnets, Lake Huron, 1979-1987. Lake Huron Fish. Assess. Unit Rep. 1-88.

Nester, R.T., and T.P. Poe 1984. First evidence of successful natural reproduction of planted lake trout in Lake Huron. North Am. J. Fish. Manage. 4:126-128.

Payne, N.R., G. Fleischer, R. McDonald, T. Morse and J. Weber 1988. Assessment of parasitic-phase sea lamprey in Lake Huron in 1987. Report to the Lake Huron Committee of the Great Lakes Fish. Comm., March 14-15, 1988.

Spangler, G.R. and A.H. Berst 1976. Performance of lake trout (Salvelinus namaycush) backcrosses, F1 splake (S. fontinalis X S. namaycush), and lake trout in Lake Huron. J. Fish. Res. Board Can. 33: 2402-2407.

Toth, G. 1984. Chinook salmon smolting investigation in selected Lake Huron-Georgian Bay tributaries, 1983. Ont. Min. Natur. Resour., Owen Sound District, MS Rep., 3 pp.

Wagner, W.C. 1980. Reproduction of planted lake trout in Lake Michigan. Fish. Res. Rep. No. 1885. Mich Dept. Natur. Resour., Fish. Div.

Table 1. Planting statistics for yearling lake trout backcross stocked in southern Georgian Bay, 1979-1987.

Planting site	1979	1980	1981	1982	1983	1984	1985	1986	1987
Mary Ward Shoal	182,176	10,000	101,531	122,147	107,770	136,617	121,348	126,559	105,102
Boucher Pt.		42,212	33,155	34,846	30,057	53,572	48,588	54,743	52,133
Meaford Harbour							31,430		
Cape Rich	108,423	123,544	120,180	100,095	97,087	130,463	115,925	123,304*	102,956
Vail Point		81,037	39,781	122,550	84,842	118,275	102,689	25,509*	26,698
Coffin Cove								25,377	26,560
Sutton Point								25,388	26,520
Pyette Point	130,558	69,157	73,460	101,025	101,560	127,864	107,957	25,354	26,550
North Keppel	28,063				3,584		12,853	6,004	
White Cloud I.		60,727	64,469	31,441	21,006	37,096	12,781	13,485	
Griffith I.				78,178	69,038	17,415	6,391	12,605	5,095
Cameron Point							17,762	27,058	15,555
Colpoys dock							6,396		
Wiarton									16,069
Cape Dundas		52,930	27,493	38,548	18,923	17,814	6,396		
Jackson Shoal	142,458	50,908	36,820	47,405	68,885	44,235	25,417	45,055	44,450
Lion's Head dock	11,113								
Total numbers	602,791	490,515	496,889	676,235	602,752	683,351	615,933	510,441	447,688
Weight (kg)	34,359	25,997	26,335	28,402	33,151	31,434	24,021	23,991	28,331

An additional release of 63,188 fall fingerlings occurred in October 1983 at Dyer's Bay, north of Lion's Head. This was an unscheduled planting of fish whose transfer to the Sandfield hatchery on Manitoulin Island was interrupted by a weather delay while on board a ferry· the fish were released when the oxygen supply neared depletion.

*Also planted in 1986 and 1987 in Owen Sound (Vail Pt., Coffin Cove, Sutton Pt., and Pyette Pt.) were 100,671 and 110,135 lake trout as part of a paired planting experiment.

Table 2. Total catch by mesh size from index gillnetting at Cape Rich, August 1987.

Species	Mesh size mm:	38	51	64	76	89	102	114	127	Total
	in:	1.5	2.0	2.5	3.0	3.5	4.0	4.5	5.0	
sea lamprey					1			1		2
alewife		2082	1003	37	31	27	25	15	20	3240
pink salmon						1				1
coho salmon						1				1
chinook salmon		8	6	2	1	2				19
rainbow trout		6	15	4	1			3	2	31
brown trout				1						1
lake trout			27	36	12	1		1	1	78
backcross		130	332	306	225	189	162	163	134	1641
lake trout sp.			13	10	4		1			28
lake whitefish		1	23	20	15	14	22	38	44	177
lake herring				1						1
bloater		45	57	9				1		112
round whitefish			1	1	1					3
rainbow smelt		35	57	60	40	31	19	10	12	264
longnose sucker			21	49	104	136	79	21	3	413
white sucker		3	105	298	311	245	110	14	3	1089
lake chub		18								18
burbot		4	10	9	10	13	27	24	23	120
rock bass					1					1
yellow perch		12	62	16	3					93
Totals:		2344	1732	859	760	660	445	291	242	7333

Table 3. Total catch by mesh size from index gillnetting in Owen Sound bay, August 1987.

Species	Mesh size mm:	38	51	64	76	89	102	114	127	Total
	in:	1.5	2.0	2.5	3.0	3.5	4.0	4.5	5.0	
sea lamprey					1	1				2
alewife		733	965	16	9	7	14	5	5	1754
chinook salmon		1	17	4		1			1	24
rainbow trout		1	10	5	1			2		19
brown trout		1	1				1			3
lake trout		3	10	7	3		1	1		25
backcross		36	93	96	64	57	73	38	49	506
lake trout sp.		2	3	5	2	1				13
lake whitefish				2	3	3	6	2	5	21
bloater		578	913	66	22	11	10	5	3	1608
round whitefish			2	4						6
rainbow smelt		63	184	202	140	47	72	26	35	769
longnose sucker		7	65	69	107	113	50	7	1	419
white sucker		1	31	204	233	239	89	9	3	809
lake chub		19			1					20
burbot		18	41	47	61	81	60	20	17	345
yellow perch		3	30	15	6					54
Totals:		1466	2365	742	653	561	376	115	119	6397

Table 4. Index gillnetting CUEs (no/1000 m) at Cape Rich, 1979-1987. (Not adjusted for shorter length of 38 mm mesh panels.)

Species	1979	1980	1981	1982	1983	1984	1985	1986	1987
sea lamprey	0.02	-	0.02	-	-	0.03	-	0.15	0.07
alewife	2.08	5.78	5.59	3.88	17.00	0.06	1.86	2.70	118.11
pink salmon	-	-	0.02	-	0.03	-	0.03	-	0.04
coho salmon	-	0.05	-	-	-	-	-	-	0.04
chinook salmon	0.04	0.21	0.53	0.36	0.52	0.27	0.36	1.31	0.69
rainbow trout	-	-	0.12	0.05	0.18	0.18	0.10	0.26	1.13
brown trout	-	-	0.02	0.03	-	0.06	-	-	0.04
brook trout	-	-	0.02	-	-	-	-	-	-
lake trout	-	-	-	-	-	-	-	-	2.84
lake trout backcross	27.41	76.37	39.50	35.58	33.97	73.29	65.35	69.77	59.82
lake trout sp.	-	-	-	-	-	-	-	-	1.02
lake whitefish	3.52	8.28	1.48	2.66	1.77	6.07	7.79	4.88	6.45
lake herring	0.05	0.10	0.27	0.10	-	0.06	-	-	-
bloater	3.94	9.35	4.03	8.85	1.82	6.13	32.34	18.19	4.08
round whitefish	0.16	0.26	0.17	0.29	0.21	0.39	0.46	0.51	0.11
rainbow smelt	42.97	111.28	53.50	83.87	32.72	28.76	60.75	46.33	9.62
longnose sucker	4.65	8.56	5.73	8.30	10.91	33.83	16.47	15.27	15.06
white sucker	35.44	71.09	110.50	63.52	60.47	85.13	53.16	60.59	39.70
lake chub	1.26	1.80	1.43	2.81	2.58	2.13	0.50	1.28	0.66
carp	0.02	-	0.02	0.03	-	-	-	-	-
burbot	0.49	0.89	0.49	2.00	2.52	3.01	4.71	3.50	4.37
trout-perch	-	-	-	-	-	0.03	-	-	-
rock bass	-	-	0.02	-	-	-	-	-	0.04
smallmouth bass	0.02	-	-	-	-	-	-	-	-
yellow perch	0.84	1.56	26.29	4.27	1.25	12.12	19.12	19.65	3.39
Total CUE	114.27	295.58	249.78	216.55	165.95	251.46	263.00	244.46	267.32
Effort (x 1000 m)	54.86	38.40	41.15	38.40	38.40	32.92	30.18	27.43	27.43

Table 5. Index gillnetting CUEs (no/1000 m) at Owen Sound, 1984-1987. (Not adjusted for shorter length of 38 mm mesh panels.)

Species	1984	1985	1986	1987
sea lamprey	-	0.2	-	0.2
alewife	0.3	7.2	24.4	159.8
chinook salmon	0.3	1.2	0.8	2.3
rainbow trout	0.1	0.1	0.1	1.7
brown trout	0.5	0.3	0.3	0.3
lake trout	-	-	0.1	2.3
lake trout backcross	106.9	91.1	75.3	46.1
lake trout sp.	-	-	0.1	1.2
lake whitefish	7.7	2.8	2.3	1.9
bloater	12.0	10.6	53.0	146.5
round whitefish	0.5	0.3	0.5	0.5
rainbow smelt	47.2	109.1	61.4	70.1
longnose sucker	39.4	54.0	32.5	38.2
white sucker	28.4	32.4	22.1	73.6
lake chub	2.2	3.0	0.8	1.8
burbot	13.0	23.4	27.4	31.4
yellow perch	8.3	22.3	47.1	4.9
Total CUE	266.7	358.1	348.4	582.7
Effort (X 1000 m)	10.97	9.60	10.97	10.97

Table 6. Summary of index gillnet catches of lake trout backcross at Cape Rich, 1979-1987, and Owen Sound, 1984-1987.

	Project year	Number caught	CUE		Mean weight (kg)
			No/1000m	Kg/1000m	
Cape Rich					
	1979	1504	27.4	6.2	0.23
	1980	2934	76.4	24.9	0.33
	1981	1626	39.5	13.1	0.33
	1982	1365	35.6	31.2	0.88
	1983	1305	34.0	12.1	0.36
	1984	2410	73.3	53.4	0.73
	1985	1972	65.4	88.3	1.35
	1986	1914	69.8	118.6	1.70
	1987	1641	59.8	77.8	1.30
Owen Sound					
	1984	1173	107.0	80.0	0.75
	1985	875	91.1	106.9	1.17
	1986	826	75.3	111.4	1.48
	1987	506	46.1	71.1	1.54

Table 7. Backcross age distribution by mesh size from index gillnetting at Cape Rich, August 1987 (adjusted for 38 mm mesh panel lengths).

Mesh size		Age								Total
mm	(in)	1	2	3	4	5	6	7	8	
38	(1.5)	194	11	9	8	5	0	0	0	227
51	(2.0)	350	75	33	32	12	5	0	0	507
64	(2.5)	52	120	80	50	21	5	4	0	332
76	(3.0)	6	87	57	48	18	9	1	1	227
89	(3.5)	8	50	50	51	23	7	2	2	193
102	(4.0)	4	28	57	46	23	5	1	0	164
114	(4.5)	6	11	60	58	24	4	2	1	166
127	(5.0)	8	10	39	57	18	6	0	0	138
Total:		628	392	385	350	144	41	10	4	1954

Table 8. Backcross age distribution by mesh size from index gillnetting at Owen Sound, August 1987 (adjusted for 38 mm mesh panel lengths).

Mesh size		Age								Total
(mm)	(in)	1	2	3	4	5	6	7	8	
38	(1.5)	58	2	0	2	2	0	1	0	65
51	(2.0)	68	17	15	14	7	6	0	0	127
64	(2.5)	12	33	16	33	8	0	0	0	102
76	(3.0)	6	14	15	19	10	2	1	0	67
89	(3.5)	2	11	18	13	13	1	0	0	58
102	(4.0)	4	4	23	28	15	0	1	0	75
114	(4.5)	4	2	11	17	5	1	0	0	40
127	(5.0)	0	3	10	25	5	3	2	1	49
Total:		154	86	108	151	65	13	5	1	583

Table 9. CUE-at-age summary for lake trout backcross from index gillnetting at Cape Rich, 1979-1987, and Owen Sound, 1984-1987.

Year	Age (yr)								Total CUE	Mean age
	1	2	3	4	5	6	7	8		
Cape Rich										
1979	27.5	-	-	-	-	-	-	-	27.5	1.00
1980	67.1	14.4	-	-	-	-	-	-	81.5	1.18
1981	32.7	8.3	0.7	-	-	-	-	-	41.8	1.23
1982	4.4	25.6	4.6	0.6	-	-	-	-	35.1	2.05
1983	23.6	10.2	2.1	0.2	0.0	-	-	-	36.2	1.41
1984	22.61	36.10	13.91	2.29	0.26	0.00	-	-	76.11	1.93
1985	8.54	18.42	28.61	8.51	1.18	0.12	0.00	-	65.40	2.63
1986	10.94	8.51	20.37	24.98	4.10	0.55	0.10	0.00	69.55	3.07
1987	14.05	13.77	13.47	12.23	5.09	1.40	0.34	0.14	60.49	2.78
Owen Sound										
1984	13.24	61.52	21.02	3.25	0.43	0.00	-	-	100.22	2.16
1985	9.57	36.81	34.47	9.96	0.78	0.00	0.00	-	91.59	2.51
1986	5.47	16.92	27.34	18.11	4.19	1.28	0.34	0.00	73.99	3.04
1987	9.06	7.52	9.23	13.07	5.72	1.11	0.51	0.09	46.31	3.10

Note: Backcross plantings in Owen Sound in 1986 and 1987 were about half of previous level, due to matched planting of lake trout.

Table 10. Estimated total annual mortality for lake trout backcross from index gillnetting at Cape Rich and Owen Sound, 1984-1987.

Ages	Total mortality (%)		
	1984-85	1985-86	1986-87
Cape Rich			
2 to 3	21	(-11)	(-57)
3 to 4	39	13	40
4 to 5	49	52	79
5 to 6	54	53	66
6 to 7		17	38
7 to 8			(-40)
Owen Sound			
2 to 3	44	26	45
3 to 4	53	48	52
4 to 5	76	58	68
5 to 6	100	(-64)	74
6 to 7		(nn)	60
7 to 8			74

Table 11. Fork length/age distribution of backcross sampled from index gillnetting at Cape Rich, August 1987.

FL class (cm)	Age (yr)								Total
	1	2	3	4	5	6	7	8	
14	1								1
16	11								11
18	28								28
20	58								58
22	100	2		1					103
24	85	2							87
26	21	11							32
28	8	24	4						36
30	1	52	11	1					65
32	1	68	12						81
34		71	15	2	2				90
36		57	15	1					73
38		42	10	1	1				54
40		37	26	2					65
42		15	47	4	1				67
44		6	41	11	1	6	1		66
46		2	51	17	4	4			78
48		1	62	30	7	1			101
50		1	50	40	6	2			99
52			18	48	13	1	1		84
54		1	15	62	19	3	2		103
56			3	57	22	1	1		85
58			3	31	20	5	1		60
60				29	22	5	2		58
62				7	15	5	1	2	30
64			1	1	5	3		1	11
66				2	4		1	1	8
68					1	2			3
70					1				1
72						2			2
Total:	314	392	385	350	144	41	10	4	1640
Mean FL(mm):	230	352	454	538	570	568	567	646	419
Mean wt(g):	134	565	1330	2254	2828	2804	2739	3773	1300
Males									
Number:	165	223	230	174	66	23	5	1	887
Mean FL:	232	357	462	532	569	535	562	637	417
Mean wt:	142	595	1384	2125	2751	2421	2818	3404	1242
Females									
Number:	127	165	152	174	78	18	5	2	721
Mean FL:	230	347	442	545	571	610	572	658	427
Mean wt:	129	530	1254	2383	2892	3295	2661	3997	1407

Table 12. Fork length/age distribution of backcross sampled from index gillnetting at Owen Sound, August 1987.

FL class (cm)	Age (yr)								Total
	1	2	3	4	5	6	7	8	
16	3								3
18	6								6
20	19	2							21
22	20	1							21
24	21	2	1						24
26	6	3	1						10
28		6							6
30	1	15	1						17
32		14	1						15
34		12	4	1					17
36		12	1	1					14
38		7	6	1					14
40		5	5	1	1				12
42		5	10	4	1				20
44		1	26	1		1			29
46		1	21	10					32
48			14	17	1				32
50			5	13	4				22
52			9	22	3	1			35
54			2	26	6	1	1		36
56			1	27	9	2	1		40
58				17	6	1			24
60				4	14	1			19
62				5	9	3		1	18
64				1	5	1	2		9
66					6	2			8
68									0
70							1		1
n.a.:	1								1
Total:	77	86	108	151	65	13	5	1	506
Mean FL(mm):	228	341	454	535	591	597	626	620	448
Mean wt(g):	126	497	1283	2171	3067	3112	3568	3380	1541
Males									
Number:	37	43	55	68	25	4	1	1	234
Mean FL:	229	341	452	532	597	598	567	620	439
Mean wt:	128	495	1286	2160	3136	3309	2962	3380	1460
Females									
Number:	33	43	53	83	40	9	4	0	265
Mean FL:	228	341	455	536	586	597	641		461
Mean wt:	127	499	1281	2180	3024	3024	3720		1651

Table 13. Length/maturity of lake trout backcross from index gillnetting in southern Georgian Bay, August 1987.

Fork length class (cm)	Cape Rich				Owen Sound			
	Males		Females		Males		Females	
	imm.	mat.	imm.	mat.	imm.	mat.	imm.	mat.
16	8	0	2	0	0	0	2	0
18	14	0	9	0	3	0	2	0
20	29	0	22	0	11	0	10	0
22	46	0	53	0	10	0	9	0
24	46	0	37	0	13	0	9	0
26	20	0	12	0	6	0	4	0
28	22	0	13	0	4	0	2	0
30	30	0	32	1	5	0	12	0
32	42	1	35	2	7	0	8	0
34	49	2	36	2	11	0	6	0
36	34	3	33	3	8	0	6	0
38	26	6	19	2	7	0	7	0
40	22	17	20	5	4	3	5	0
42	11	25	21	10	3	3	10	4
44	7	38	11	10	6	12	10	1
46	9	43	12	13	4	11	12	5
48	9	56	7	29	3	11	6	12
50	1	65	5	27	1	5	0	16
52	0	45	3	36	1	17	2	15
54	0	49	3	51	0	18	2	16
56	0	35	3	46	0	16	2	22
58	1	30	3	26	0	8	0	16
60	1	23	2	32	0	8	0	11
62	0	12	0	17	0	10	1	7
64	0	4	0	7	0	1	0	8
66	0	3	1	4	1	3	0	4
68	0	1	0	2	0	0	0	0
70	0	1	0	0	0	0	0	1
72	0	0	0	2	0	0	0	0
Totals:	427	459	394	327	108	126	127	138

Table 14. Age/maturity of lake trout backcross from index gillnetting in southern Georgian Bay, August 1987.

Age (yr)	Males					Females				
	Cape Rich		Owen Sound		%	Cape Rich		Owen Sound		%
	imm.	mat.	imm.	mat.	mat.	imm.	mat.	imm.	mat.	mat.
1	165	0	37	0	0%	127	0	33	0	0
2	196	27	41	2	11	157	8	43	0	4
3	56	174	23	32	72	91	61	40	13	36
4	4	170	5	63	96	13	161	10	73	91
5	3	63	2	23		4	74	1	39	
6	4	19	0	4	93	1	17	0	9	96
7	0	5	0	1		0	5	0	4	
8	0	1	0	1		1	1	0	0	

Table 15. Percent frequency (and counts of fish prey) for stomach contents of lake trout backcross and burbot from index gillnetting in southern Georgian Bay, August 1987.

Stomach contents	Backcross		Burbot	
	Cape Rich (n=1640)	Owen Sound (n=506)	Cape Rich (n=120)	Owen Sound (n=345)
Empty	34.1%	39.1%	27.5%	43.2%
Fish remains	23.4	22.7	25.0	22.0
Smelt	40.0 (1603)	32.6 (484)	29.2 (64)	19.4 (141)
Sculpin	0.5 (14)	0.2 (1)	5.8 (12)	2.9 (25)
Alewife	0.2 (4)	0.0	10.8 (13)	3.5 (15)
Stickleback	0.1 (3)	0.2 (1)	0.8 (1)	0.3 (1)
Darter sp.	<0.1 (1)	0.2 (1)	0.0	0.6 (4)
Salmon sp.	0.0	0.0	0.8 (1)	0.0
Bloater	0.0	0.0	0.0	0.3 (1)
Yellow perch	0.0	0.0	0.8 (1)	0.0
Crayfish	0.0	0.0	12.5 (16)	9.9 (46)
Crustaceans	2.4	5.9	4.2	13.9
Insects	<0.1	1.0	0.0	0.3
Other	<0.1	0.0	0.0	0.0

Table 16. Results of fry emergence trapping for backcross in Owen Sound, 1985-1987.

Year	Number caught	C.U.E. (no/trap-night)	Density (no/m^2)
1985	3	0.010	0.75
1986	14	0.030	3.09
1987	1	0.004	0.22

(See text for problems with 1987 data.)

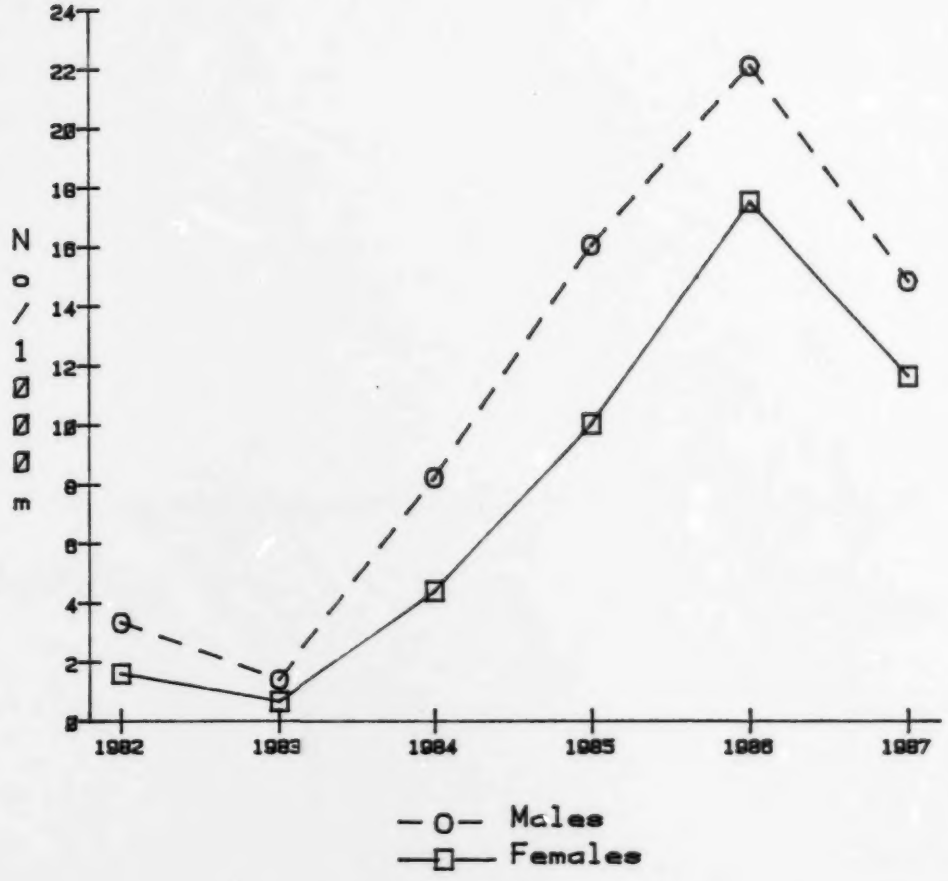
Table 17. Occurrence of lake trout backcross with no apparent fin clip (as percentages of each age group), from index gillnetting in southern Georgian Bay (1986-87).

Year		Age (yr)					
		1	2	3	4	5	>5
1986	(n=2740)	0.0	0.7	0.2	0.3	1.8	2.8
1987	(n=2144)	0.3	0.2	0.0	0.4	0.5	0.0

Table 18. Lamprey marking rates on lake trout backcross from index gillnetting in Cape Rich and Owen Sound, August 1987.

	Cape Rich (n=1640)	Owen Sound (n=506)
wounds/100 fish:	1.95	1.78
scars/100 fish:	4.15	6.72
Total marks/100 fish:	6.10	8.50

Figure 1. Index gillnet CUEs for mature backcross at Cape Rich



APPENDIX A

Common and scientific names of fishes from index gillnetting for lake trout backcross in southern Georgian Bay, 1979-1987.

Common name	Scientific name
sea lamprey	*Petromyzon marinus*
alewife	*Alosa pseudoharengus*
pink salmon	*Oncorhynchus gorbuscha*
coho salmon	*O. kisutch*
chinook salmon	*O. tschawytscha*
rainbow trout	*Salmo gairdneri*
brown trout	*S. trutta*
brook trout	*Salvelinus fontinalis*
lake trout	*S. namaycush*
splake	*S. fontinalis* X *S. namaycush*
lake trout backcross	(*S. fontinalis* X *S. namaycush*) X *S. namaycush*
lake whitefish	*Coregonus clupeaformis*
lake herring	*C. artedii*
bloater	*C. hoyi*
round whitefish	*Prosopium cylindraceum*
rainbow smelt	*Osmerus mordax*
longnose sucker	*Catostomus catostomus*
white sucker	*C. commersoni*
lake chub	*Couesius plumbeus*
carp	*Cyprinus carpio*
burbot	*Lota lota*
trout-perch	*Percopsis omiscomaycus*
rock bass	*Ambloplites rupestris*
smallmouth bass	*Micropterus dolomieui*
yellow perch	*Perca flavescens*

APPENDIX B

Catches, depth and temperature data from individual gillnet sets for lake trout backcross in southern Georgian Bay, 1987.

Table B-1. Total catch by catch number from index gillnetting at Cape Rich, August 1987.

Part A: Sets perpendicular to shore

Species	Catch number										Total
	201-2	203-4	209-10	211-12	217-18	219-20	225-6	227-8	233-4	235-6	
sea lamprey	1										1
alewife	88	1		193	2	123	443	220	5	155	1233
chinook salmon							4		2	3	9
rainbow trout	4	1					2		1	6	14
brown trout										1	1
lake trout	5	4	2	3	2	4	6	2	9	2	39
backcross	197	157	99	136	22	77	83	49	62	66	958
lake trout sp.		1	2	3	1	1	1			1	11
lake whitefish	19	20	11	9	6	1	16	5	6	10	108
lake herring								1			1
bloater	1	27	3	1	40	11		2	4	3	91
round whitefish	2									1	3
rainbow smelt	1	1	3	6	6		43		1	13	75
longnose sucker	46	33	18	20	4	2	36	4	60	23	247
white sucker	205	32	12	65			92		60	83	549
lake chub	3									5	8
burbot	4	6	3	16	16	11		10		8	83
rock bass									1		1
yellow perch	15			1			1			5	22
Total:	593	284	165	453	103	230	727	293	218	386	3452
Depth (m):	22	27	27	24	29	27	18	25	24	26	25
Temp. (C):	9.6	7.2	6.8	8.1	6.7	6.8	11.5	6.4	9.5	6.8	7.9

Table B-1 (cont'd) Part B: Sets parallel to shore

Species	Catch number										Total	Grand total
	205-6	207-8	213-14	215-16	221-2	223-4	229-30	231-2	237-8	239-40		
sea lamprey						1					1	2
alewife	9	141	8	457	11	102	121	3	522	633	2007	3240
pink salmon									1		1	1
coho salmon									1		1	1
chinook salmon						1	8		1		10	19
rainbow trout		5					2		2	8	17	31
brown trout											0	1
lake trout	5	3	4	1	4	6	5	4	7		39	78
backcross	82	92	55	45	40	85	152	40	71	21	683	1641
lake trout sp.	3		1			3	4	3	3		17	28
lake whitefish	5	10	2	3	2	12	10	2	23		69	177
lake herring											0	1
bloater	2	1	3		6	3	3	1	2		21	112
round whitefish											0	3
rainbow smelt	1	4	3	3		3	39	2	109	25	189	264
longnose sucker	9	48	3	16	2	27	29	5	16	11	166	413
white sucker		111	3	27	1	36	199	4	91	68	540	1089
lake chub										10	10	18
burbot	3	3	10	2	2	5	4	2	6		37	120
rock bass											0	1
yellow perch							29			42	71	93
Total:	119	418	92	554	68	284	605	66	855	818	3879	7333
Depth (m):	26	21	24	21	25	20	20	25	25	20	23	24
Temp. (C):	6.9	9.7	6.6	7.8	6.4	8.1	11.0	6.1	12.6	12.7	8.8	8.4

Table B-2. Total catch by catch no. from index gillnetting in Owen Sound, August 1987.

Species	Catch number								Total
SITE:	101-2 Sutton	103-4 Pyette	105-6 Coffin	107-8 Vail	109-10 Pyette	111-12 Vail	113-14 Sutton	115-16 Coffin	
sea lamprey				1	1				2
alewife	233	424	87	6	214	143	341	306	1754
chinook salmon			2	5			2	15	24
rainbow trout			1	2	1		1	14	19
brown trout			2				1		3
lake trout	1	1	12	4		7			25
backcross	61	70	62	53	60	107	59	34	506
lake trout sp.		1	2	2	1	6	1		13
lake whitefish	7	6		1	3	1	2	1	21
bloater	9	53	817	506		174	2	47	1608
round whitefish		5		1					6
rainbow smelt	128	24	179	295	16	16	43	96	769
longnose sucker	55	16	41	135	8	73	33	58	419
white sucker	125	24	86	354	12	41	62	105	809
lake chub								20	20
burbot	54	85	46	48	63	31	15	3	345
yellow perch	28		6	3	1		8	8	54
Total:	701	709	1315	1416	380	599	570	707	6397
Depth (m):	41	42	39	41	33	34	28	23	35
Temp. (C):	16.3	15.0	15.3	14.4	12.3	11.9	11.6	15.1	14.0